Welcome to Heavy Flavor Topical Group Meeting

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HF-topical group

▸ **HF in sPHENIX**: in particular B-meson and b-jets, provide differentiating sensitivity to collision VS radiative energy loss, access to HQ transport parameter of QGP, total cross section. Bring results to precision era.
  ◦ *B*-meson: access down to zero pT, max sensitivity to HQ mass effect
  ◦ *b*-Jet: less dependence on FF complication, probing parton kinematics and higher p_T-scale

▸ **High priority task are set to develop and simulate performance for coming MVTX reviews and proposals**, expanding the program in HF-jet and HF-meson programs
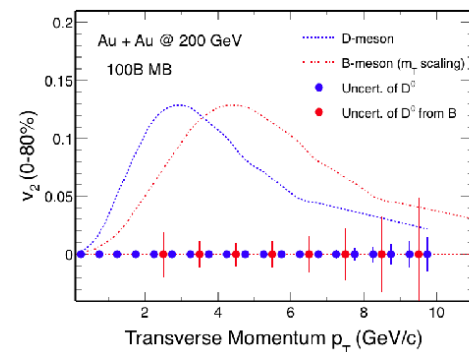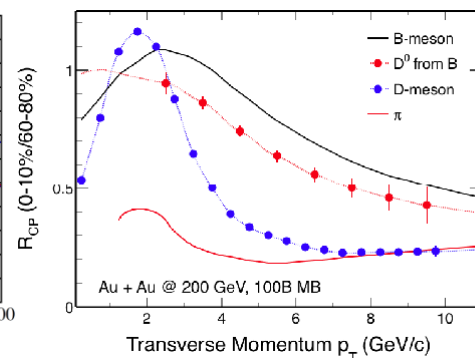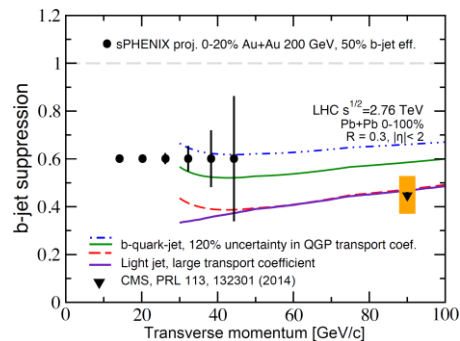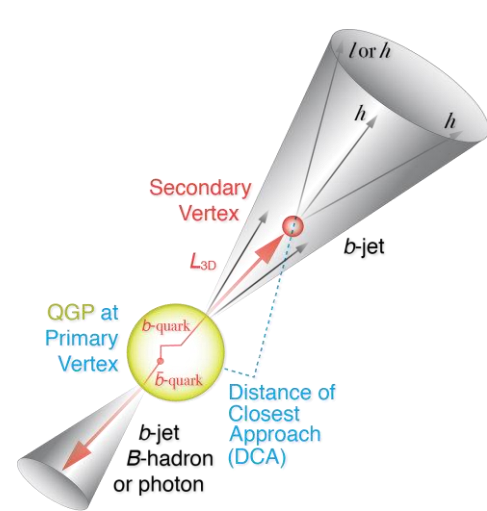
▸ Communication:
  ◦ Discussion email list: https://lists.bnl.gov/mailman/listinfo/sphenix-hf-jets-l
  ◦ Wiki page under construction: https://wiki.bnl.gov/sPHENIX/index.php/Heavy_Flavor_Topical_Group

▸ Meetings/Events
  ◦ Use weekly simulation meetings for updates, https://indico.bnl.gov/categoryDisplay.py?categId=88
  ◦ Monthly TG meetings: https://indico.bnl.gov/categoryDisplay.py?categId=151
  ◦ Goal oriented irregular events:
    MVTX brainstorming meeting, Mar 8 / MAPS+HF-jet joint workfests, e.g. Jan 5-7 2017 @ Santa Fe / Pre-collaboration meeting work-fest on May 16-17, 2016 / Initial TG meeting on Apr 22 , 2016
  ◦ Expect new workfest between BNL director review on MVTX and full proposal to DOE

Key dates and events

- Soonish (?): sPHENIX nominal run plan and update all statistical projections
- End-May: new tracking software (see Haiwang's talk)
- June: submission of analysis notes (next slides)
- Jun 12: pre-collaboration meeting @ BNL ← please attend
  - Encourage HF TG participation in the work-day @ BNL
  - Focusing on using the new tracking software for HF simulations
- Jun 13-14: sPHENIX collaboration meeting @ BNL
- Jun 15-16: RHIC PAC meeting
- Jun 19: sPHENIX-charged MVTX Director's review dry-run (see Ming/Xuan's talk)
- Jul 10-11: sPHENIX MVTX Director's review (see Ming/Xuan's talk)
  - Major review on both science case and detector cost/schedule
- Later summer: MVTX proposal submission to DOE
- Expect DOE review later in 2017 or early 2018

sPHENIX Analysis notes

- Two analysis notes will be lead by HF TG:
- b-jet physics performance (inclusive and di-b-jet)
  - Primary authors: Anthony Frawley, Jin Huang(*), Xuan Li, Sanghoon Lim, Ming Liu, Mike McCumber, Darren McGlinchey, Gaku Mitsuka, Dennis Perepelitsa, Cesar da Silva, Haiwang Yu
- B-hadron physics via non-prompt D0
  - Primary authors: Xiaolong Chen, Xin Dong(*), Guannan Xie
- Expect template and author's link soon

MVTX proposal TODO
Technical performances:

- Realistic implementation in Geant4
  - **Completed**: implement ladder structure in simulation – Tony F., Gaku M.
  - **Completed** : digitization of MAPS detector - Tony F.
  - **Pending tracking software**: Update tracking performance plots for MAPS, DCA and dp/p resolutiosn - Tony F.
  - **By summer (?)**: complete the pile-up simulation framework – Mike M., Yorito Y.
- *b*-jet tagging algorithm
  - **By summer, help needed** : Investigating full-detector fast simulation for b-jet simulation. Look into general packages e.g. DELPHES.
  - **By summer**: Full calorimetry simulation with secondary vertexing tagger – Sanghoon L.
  - **By summer**: Full calorimetry simulation with high-DCA track counting – Haiwang Y.
  - It will be very useful to use new in-development pattern recognition software to bring back hit collection efficiency.
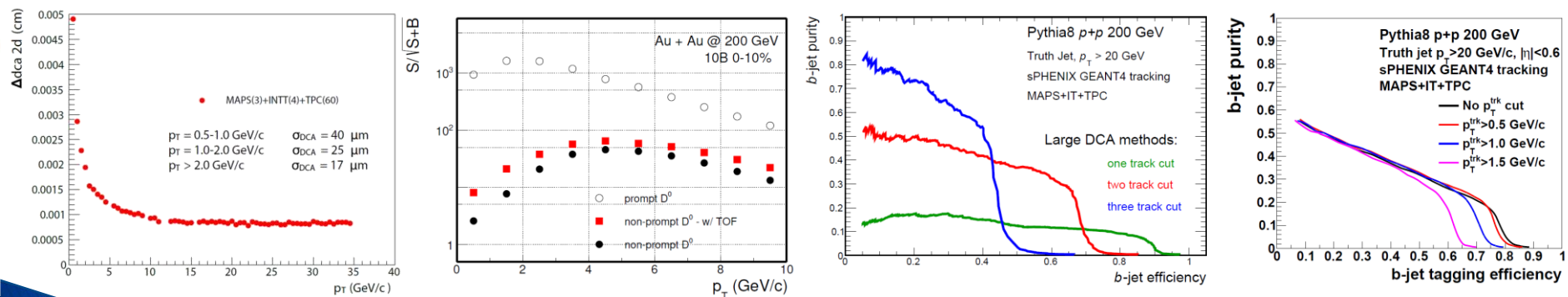
MVTX proposal TODO
Physics performances:

- Update non-prompt D meson performance projection
  - **Completed :** update the Rcp and v2 plot with more realistic simulations for MB and peripheral collisions - Xin D., Xiaolong C.
- Explore complimentary B-hadron channels beyond non-prompt-D
  - **By summer**: Fast simulation for exclusive channels, B->J/Psi K, B->D pi - Xin D., Xiaolong C.
  - **By summer, help needed**: B->non-prompt J/Psi->e$^+$/e$^-$ and p+p triggering
- Inclusive b-jet R$_{AA}$
  - **On-going:** Update theory curve to RHIC energy – Cesar da S. working with Vitev group
  - **Deliverable soon (?)**: Update theory curve for RHIC energy for R$_{AA}$ plot
- di-b-jet asymmetry
  - **On-going:** Extract di-jet purity from Geant4 simulation - Haiwang Y.
  - **Deliverable soon (?)**: Apply di-jet purity to projection – Darren M., Haiwang Y.
- b-jet-non-prompt-D asymmetry:
  - **On-going:** Produce uncertainty projection in fast simulation – Xuan L.
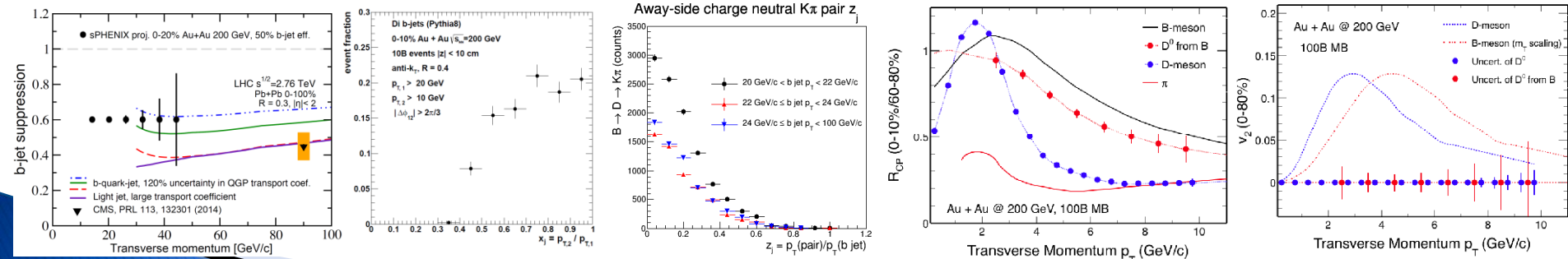
Additional study wish list Help (always) wanted

- **HF-hadron chemistry**: e.g. high stat. Λ_c, to study HQ hadronization (See Xin D.'s talk)
- **HF-meson correlations**, e.g. D-D_bar azimuthal correlations, to enhance sensitivity to HQ-medium interaction; enhance M/pT ratio scale comparing to D-b-jet correlation. (See Xin D.'s talk)
- Explore **b-jet substructure tools**:
  - Exercise jet-grooming algorithm, FF. – in collaboration with Jet Structure group
  - Tagging gluon splitting via multi-decay vertex in inclusive b-jets.
- Explore **Charmed-quark jet**:
  - charm fragmentation, completes mass hierarchy. Select D meson formed late in formation
  - Try out prompt-D tagger (ALI-PREL-117896) and Corrected Secondary vertex (arXiv:1612.08972). (Sanghoon/Xuan expressed interests)
- Explore **tagged D-meson in correlation with opposite hard structure**
  - Tagging initial c-quark kinematics with correlations, including D-meson - jet correlation and D-meson - photon correlation
  - Study D-FF and formation of D-meson
- Further **b-jet tagging developments**
  - Try different strategy: Soft-lepton tagging
  - Optimize analysis methods: likelihood analysis and machine learning tool
- **Triggering** of B-mesons in p+p collisions
  - B->J/Psi ->e+/e-, EMCal trigger. Exploration work by Sasha L.
  - D meson calorimetry trigger, turn on.
  - Large DCA triggers?